Executive Summary

In this report, we have analyzed the expected electric (E) field strengths in the Boulder area from two proposed terrestrial DTV transmitter locations, the Eldorado Mountain site and the Squaw Mountain site. The Eldorado Mountain and Squaw Mountain sites were selected from the set of candidate sites because these two possible sites bound the propagation environment that would occur at both the Table Mountain National Radio Quiet Zone (NRQZ) and the Department of Commerce (DOC) Laboratories in Boulder. The Eldorado Mountain site affords substantial line-of-sight coverage over the Boulder area, while the Squaw Mountain site affords only indirect (diffractive) coverage over the same area. The other possible tower sites fall between these two types of propagation conditions.

The goals of this work were to determine the expected E-field strengths at the Table Mountain NRQZ located north of Boulder, Colorado and at the DOC Laboratories located at 325 Broadway in Boulder, Colorado. This study also assessed the potential impacts of the proposed sites on a broad range of Federal Government research and metrology programs that depend upon a relatively quiet radio-frequency electromagnetic environment (see Section 8). The DOC conducted tests and analyses to assess whether E-field strengths produced by the DTV transmissions from either proposed site could meet the FCC's regulatory limits for the Table Mountain NRQZ. In addition, tests and analyses were performed to ascertain the impact of DTV transmissions from either proposed site on measurement efforts that are performed on a regular basis at the DOC Laboratories.

In this study, measured and predicted E-field strengths are used to estimate the E-field strengths in the Boulder area for the proposed transmitter antenna heights of two possible transmitter locations, Eldorado Mountain and Squaw Mountain. With these predictions, we were able to determine the E-field strengths at both the DOC Laboratories and at the Table Mountain NRQZ. The results show that at the Table Mountain NRQZ, the predicted E-field strengths are about 0.3 V/m for a single transmitter on Eldorado Mountain at 1.0 MW EIRP. This number exceeds the FCC's regulatory (47 CFR 73.1030) limit by about an order of magnitude (approximately a factor of 10). At that level, research at the Table Mountain NRQZ will be compromised. The results also show that the E-field strengths at the DOC Laboratories for a single transmitter located on Eldorado Mountain are about 1 V/m for 1.0 MW EIRP. These field strengths are high enough to possibly jeopardize the sensitive measurements done on a routine basis at the DOC Laboratories, as discussed in Section 8. By comparison, the results show that, at the Table Mountain NRQZ, the predicted E-field strengths are about 0.002 V/m for a single transmitter located on Squaw Mountain with 1.0 MW EIRP. These field strengths are within the FCC's Table Mountain NRQZ regulatory (47 CFR 73.1030) limit. Thus, the results indicate that a transmitter could be located at Squaw Mountain without violating the FCC's regulatory limit or adversely impacting research at the Table Mountain NRQZ.

The data presented in this report illustrate that E-field strengths on the order of 0.5 V/m to 1 V/m could be present at the DOC Laboratories. The studies presented in Section 8

illustrate only a few of the potential problems that may be experienced at the DOC Laboratories.

The measured and modeled data presented in this report are for an EIRP of 1 MW. As indicated in the report, some of the DTV channels have maximum power allocations of 1.64 MW EIRP. The E-field strengths presented here can be transformed to a 1.64 MW EIRP by multiplying the data shown in all the figures by a factor of 1.3 (which would increase the E-field strengths by 30 %). This would result in even higher E-field strengths in the Boulder–Denver area than those presented here, and could cause even greater interference at both the DOC facilities (see Sections 5 and 9). The FCC indicated in references cited in the report that in the future, adjustments to the allocated power levels may be granted under some situations, in order to allow power levels higher than 1.64 MW. If these higher power levels are granted, the result would be even higher E-field strengths in the Boulder–Denver area than those presented here.

For DTV reception, the FCC specifies a minimum (i.e., for noise limited DTV reception) E-field strength of 41 dBμV/m (0.11 mV/m) for a receiving antenna at a height of 9.14 m (30 ft). Using the ITM prediction model, we also predicted the coverage areas where the FCC's minimum field strength for acceptable reception is met or exceeded. From the results shown here, it is seen that the two proposed transmitter locations (Eldorado Mountain and Squaw Mountain) have basically the same DTV coverage areas (see Section 6). However, the data in these results show that a transmitter on Squaw Mountain will not violate the FCC's regulatory limits protecting the Table Mountain NRQZ, if these transmissions occur on the currently allotted DTV frequencies.

In a recent document (cited in this report, see Section 9), the Advanced Television Systems Committee (ATSC) Task Force on RF System Performance has suggested that in order to overcome the indoor DTV reception problem, field strengths at the 9.14 m (30 ft) reference height may need to be increased substantially to 97 dBμV/m. This is an increase of 56 dB over the FCC minimum E-field strength, which is equivalent to an increase by a factor of approximately 631 in field strength. This 56 dB increase can be obtained by either substantially reducing the coverage area of DTV reception, by reducing the DTV payload data rate or by increasing the allocated transmitter power levels by an unrealistic 56 dB. Obviously, if transmitter power levels are increased to compensate for the indoor reception problem, higher E-field strengths than those presented in this report could occur at both the Table Mountain NRQZ and at the DOC Laboratories, as well as at other areas throughout Boulder.

While the results presented in this report are for omnidirectional or omni-azimuthal directional antenna patterns, the actual antennas that will be used for the proposed tower will have some type of antenna pattern associated with them. The report discusses (Section 7) how the results presented here can be used once the antenna pattern of the proposed towers are known.